ADVANCED FILM VIEWING LIGHT TABLE

A PROPOSAL FOR A DIGITIZED PRECISION STEREOSCOPE CARRIAGE

GENERAL:

A study of precision microscope carriages capable of positioning the three stereoscopes used with the Advanced Light Tables has been made by our personnel. The problem is to position the three stereoscopes to a .001 mm accuracy with a least count of .001 mm on a carriage that will accommodate the three units in a normal plus 90^{o} position in addition to allowing for optimum ease of dial reading. To date we have not found a conventional "off the shelf" micrometer movement which would meet all of these requirements.

In our original proposal, P-3801, we proposed to modify the [redacted] Microscope movement. Recent investigation has proved that while this unit will fulfill the positioning accuracy requirements specified for the advanced light tables, it embodies the following undesireabel features:

1. [redacted] microscope table is large, heavy, and will be difficult to mount on the advanced light tables.

2. The microscopes will be positioned well above the table surface requiring an optical repeating system to transfer the image plane from the film to the microscope objective. This feature will not allow for rhomboid separation, and additional mounting posts for positioning the scopes in both the normal and 90^{o} configurations.

3. Since the [redacted] table is large, it places the eyepieces of the stereoscopes 14 1/2 inches above the light table for a [redacted] stereoscope at its minimum working distance and considerably higher for other

stereoscopes. This heighth would not be conducive to comfortable viewing.

In order to eliminate these disadvantages, we propose to develope a stereoscope carriage capable of positioning the [redacted] stereoscopes to the desired accuracy and in addition to eliminate or reduce all of the undesireable features of the [redacted] unit listed above. An important feature which will be designed into this microscope table will be optical encoders attached to the drive screws. These encoders will provide a digital read-out of measured distance to [redacted] [redacted] (see figure 1).

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The proposed microscope table will be mounted to the present stereoscope carriage and include scope mounting posts on the top plate of the assembly as shown in figure #1. Ground lead screws, 12.5 mm in diameter with 1 mm pitch, will be used to position the stereoscope carriage in X & Y. The lead tolerance on the screws & Screw boxes will be better than .001 mm. The screws will be geared to handwheels located at the front edge of the stereoscope carriage. Coupled directly to the precision lead screws are two optical encoders [redacted] or equivalent, capable of determining lead screw motion to .001 mm. The encoders will read directly into two reversible digital counters (X & Y) mounted in a cabinet & Placed in close proximity to the interpreter. Readout will consist of five NIXIE tubes in each counter reading microscope position data to two significant digits and three decimal places. A readout of this nature will provide the optimum in readability with a minimum of reading error as might be realized by an operator reading an indicator dial.

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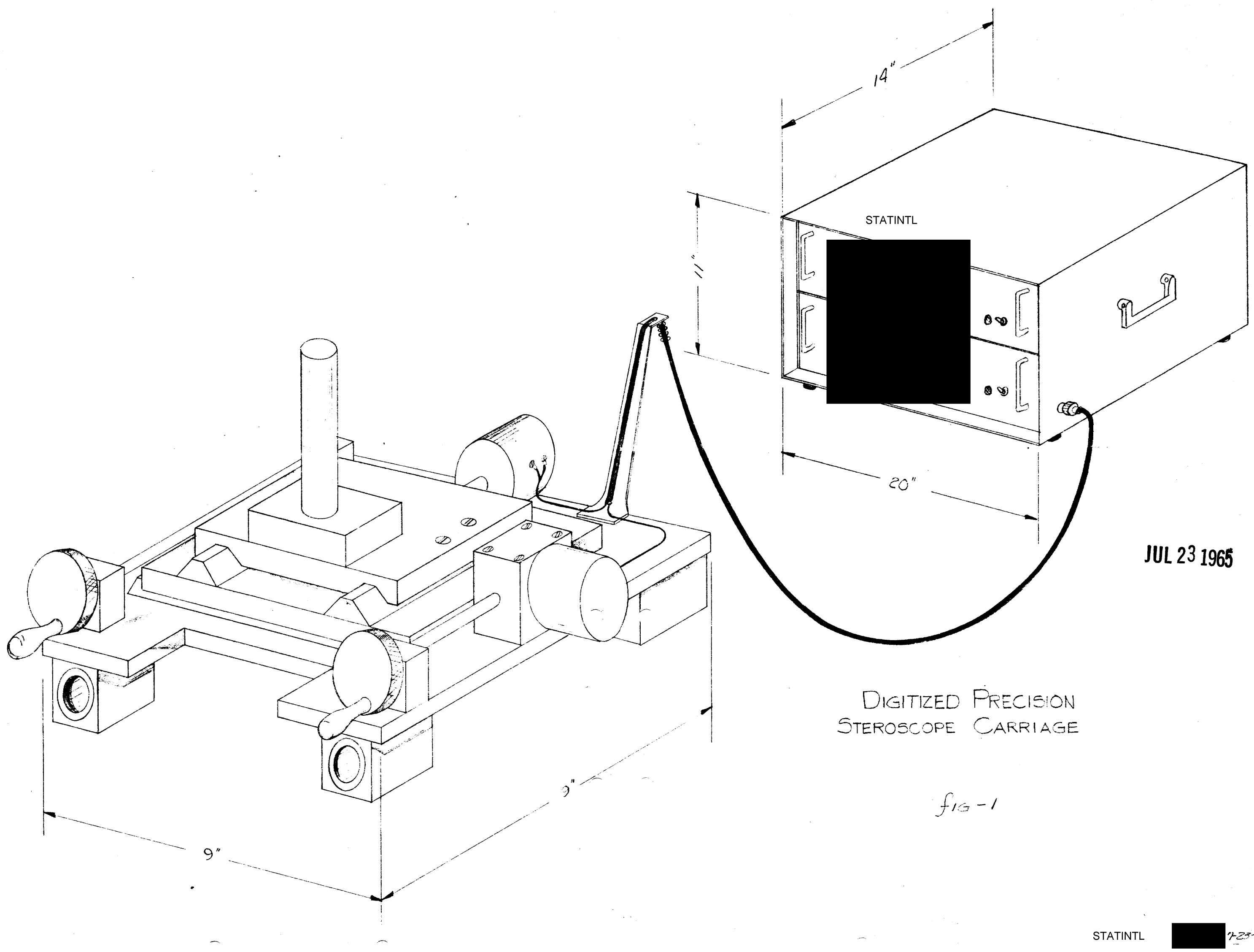

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DIGITIZED PRECISION
STEROSCOPE CARRIAGE

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ADVANCE FILM VIEWING LIGHT TABLE

A PROPOSAL FOR A DIGITAL POSITION READOUT OF THE MICROSCOPE STAND BY [redacted]

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We propose to mount two linear inductosyns to measure displacement along the X-axis and displacement along the Y-axis of the microscope stand on Tables #2 and #3, designed by [redacted] Each inductosyn consists of a "scale" which is fixed to the platform and a "slide" which is attached to the microscope. The distance traveled by the microscope will be displayed on a digital readout unit.

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We propose a linear inductosyn built by [redacted] This unit will provide the capability of measuring to an accuracy of 2.5 microns (0.0025mm).

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[redacted]

ADVANCE FILM VIEWING LIGHT TABLE

A PROPOSAL FOR MEASURING THE POSITION OF THE MICROSCOPE STAND
DESIGNED BY [redacted]

We propose to adapt the [redacted] D.I.G. system of measuring position to determine the X and Y position of the microscope. The D.I.G. system uses the principle of reading a scale to determine the position and is capable of measuring to an accuracy of 2.5 microns (o.0025mm). This method will enable us to read both the X and Y dimensions simultaneously and display them digitally, however, it is not capable of automatic digital readout.

This system does not have a storage capability. Thus each microscope position must be read and recorded. The distance traveled is obtained by manually subtracting the two recorded positions.

Lack of complete data from the vendor limits our proposal at this time to a concept. A more detailed proposal will be prepared if it is warranted when the manufacturer's design data is received.

[redacted]

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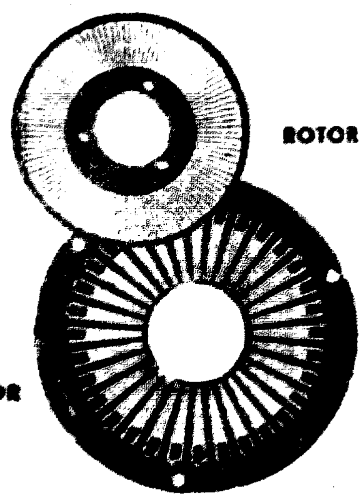

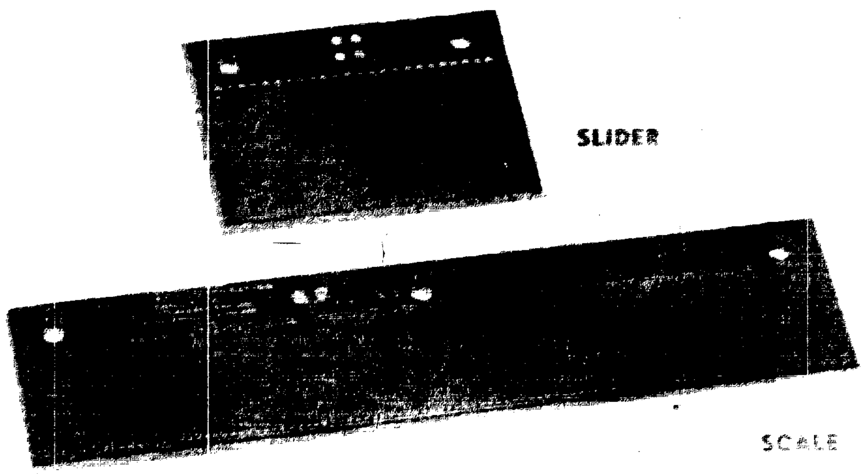

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WE ARE PLEASED TO ANNOUNCE THAT—

INDUCTOSYNS, BOTH LINEAR AND ROTARY, ARE NOW SUPPLIED MADE ENTIRELY OF METAL, INSTEAD OF MOUNTED ON GLASS AS HERETOFORE.

THE CONDUCTOR PATTERNS IS OF METALLIC COPPER .002" THICK, SECURED TO A THICK METAL BASE BY AN INSULATING BONDING LAYER .0025" THICK.

THE BASES ARE MADE OF VARIOUS METALS, *i.e.*, IRON, STEEL, (AND STAINLESS) ALUMINUM, MAGNESIUM, etc. TO MATCH THE METAL OF THE MACHINE TO WHICH IT IS MOUNTED.

THE ALL-METAL LINEAR INDUCTOSYN COMPRISES:

SCALE 10 x 2.5 x .375 INCHES
SLIDER 10 x 2.875 x .375 INCHES

WHEN SUPPLIED IN IRON, THE TRANSFORMATION RATIO IS INCREASED BY A FACTOR OF 6.

THE ALL-METAL ROTARY INDUCTOSYNS ARE SUPPLIED IN ALL METALS, THE SAME SIZE AS HERETOFORE WITH AN IMPROVED TRANSFORMATION RATIO WHEN IRON.

THE THERMAL EXPANSION OF THE INDUCTOSYN IS NOW MADE IDENTICAL TO THE MACHINE.

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INDUCTOSYN®
Principles and Applications

INTRODUCTION

The Inductosyn is a precision data element of unique form for the [illegible] measurement and control of angles or linear [illegible] inductive coupling between conductors [illegible] space. Angular accuracy of better than [illegible] linear accuracy of better than 50 micro-inches is achieved with standard units; higher accuracies are possible in special applications. 2.5 microns

The Inductosyn [illegible] Rotary and Linear forms, (Figs. 1 and 2) [illegible] a wide variety of applications in many different fields.

[illegible] in precision servo systems on machine tools and other equipment; as a primary signal generator for shaft digitizers in missile guidance applications; and in fire control and other systems.

The Linear [illegible] provides a means for accurate control of elements moving in translation, and has found its widest application in the field of automatic machine tool control.

The original Rotary Inductosyn was developed under contracts with the U. S. Air Force, to provide an angular measurement device of high accuracy for application to theodolites and missile guidance equipment. The result of this development was the 108-pole Rotary Inductosyn, wherein the active elements are metallic conductors in patterns of about one inch mean radius, formed on insulating discs. This development [illegible] a period of about four years.

Subsequent development has gradually brought the Rotary Inductosyn to its present high degree of precision, and has created a transformation into a linear array of conductors for the measurement and control of linear distances. Further, complete system equipment and components have been developed for the numerical control of either or both rotary and linear position from tape, keyboard, or other digital sources.

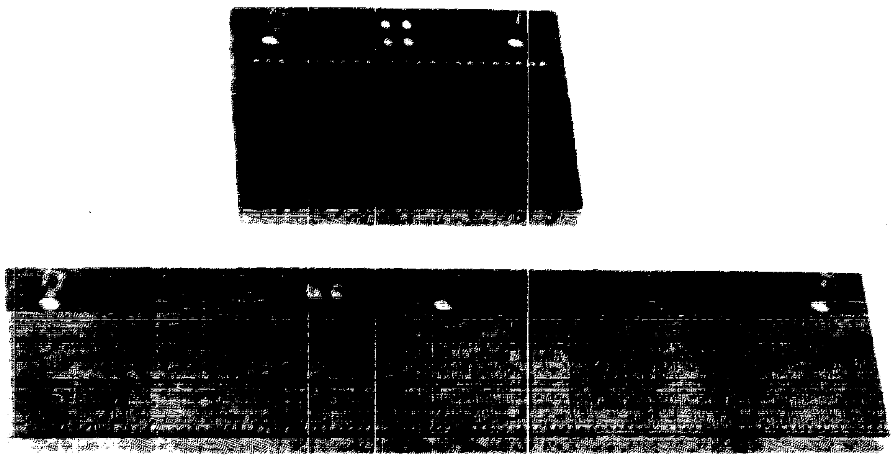


Fig. 1

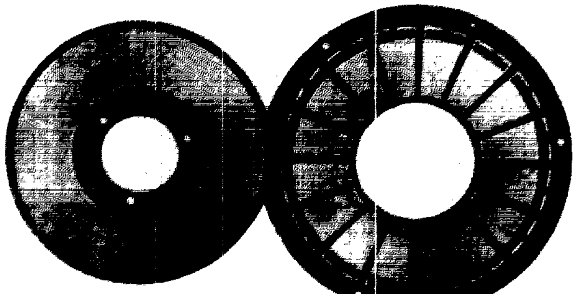


Fig. 2

THE INDUCTOSYN PRINCIPLE

The operating principle of the Inductosyn may be understood by reference to the Rotary form, which has an essential similarity to an electrical resolver or a selsyn or synchro. In all of these devices, the output signal as a function of rotation angle is obtained by the inductive coupling between stationary and moving conductors. The basic principle is well illustrated by the electromagnetic goniometer, illustrated in Figure 3. It consists of two stationary crossed coils and a third coil mounted on a rotating shaft. If two of these devices are paired and their stationary (stator) coils connected together as shown in (A) of Figure 3, they may be used as transmitter and receiver of angular data. If an a-c voltage is applied to the rotary coil (rotor) of the transmitter, a voltage maximum will appear at the rotary coil of the receiver when the two rotors are at the same angle with respect to their associated stators, and a voltage null will occur at ± 90° from this position. As the rotor of the transmitter is turned, the induced voltage in one stator coil follows a sine curve and the voltage induced in the other follows a cosine curve.

B of Figure 3 shows how one of these devices can be used to reproduce an angle in response to an input of analog voltages representing the sine and cosine of the required angle. When the output voltage of the receiver rotor is at a null, its angular position corresponds to the complement of the angle whose sine and cosine are developed in the control.

It is significant that the location of the null is not dependent on the amplitude of the EMF, but only upon the ratio of the EMF in the two stator coils—the ratio of the sine and the cosine of the required angle — which, of course, is the tangent of this angle. This ratio is obtained, in B of Figure 3, as the ratio of the resistances of the sine and cosine windings of an input potentiometer; thus angular position can be achieved in terms of resistance ratios.

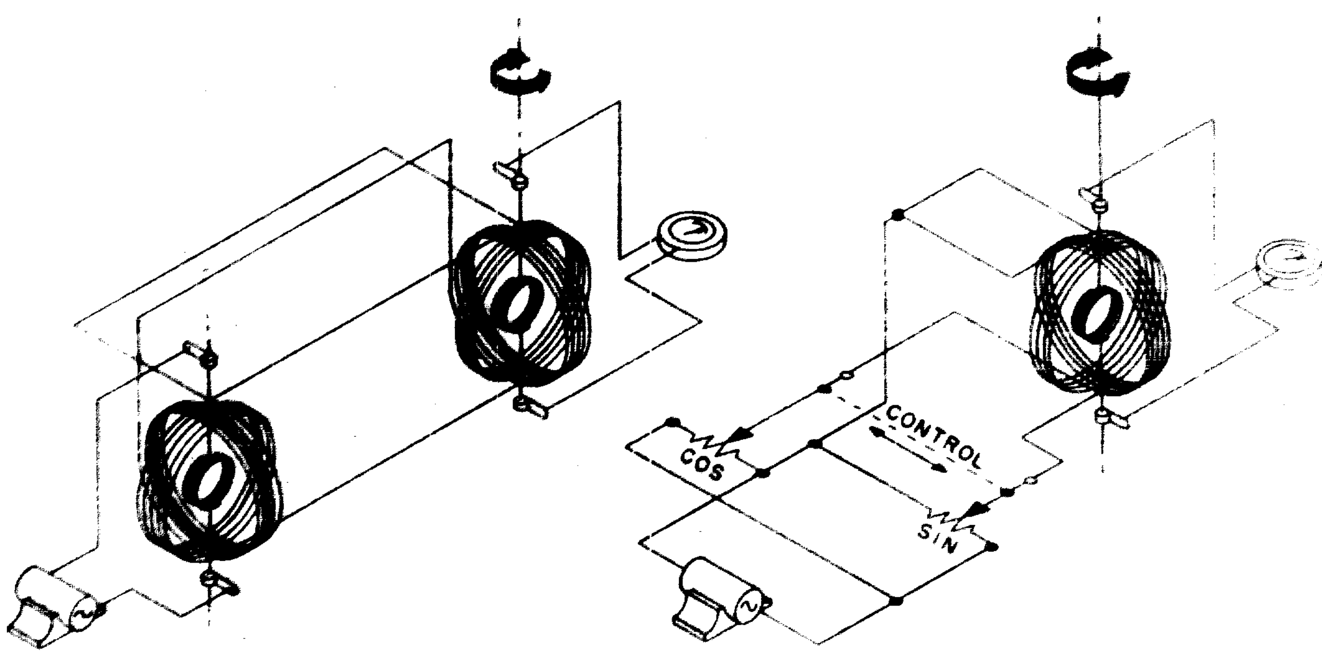
The conventional electrical resolver, which is widely used in servo and computer applications, is identical in principle to the goniometer. It is an iron-core device, constructed generally as shown in Figure 4, which indicates a two-pole arrangement, each pole being bifurcated and having windings displaced by 90 electrical degrees. The voltages induced in the stators are proportional to the sine and cosine of the mechanical angle of the transmitter rotor. A receiver whose stator windings are connected to the respective stator windings of the transmitter will produce a rotor output voltage which varies sinusoidally with the angle between rotor and stator, and is a null when the rotor-to-stator angles of transmitter and receiver are complementary.

In the Inductosyn, the coils are metallic deposits on insulating discs or plates, and are in the form of hairpin turns, as shown in Figure 5. In the Rotary form, a large number of poles are provided, (108, 144, 360 and other numbers have been constructed) so that the stator sine and cosine voltages are in the

$$\text{form } \sin\frac{N}{2}\theta \text{ and } \cos\frac{N}{2}\theta,$$

where θ is the angle of rotation of rotor with respect [illegible] and N is the number of poles. Thus the cycle of the [illegible] double the pole spacing, and the number of cycles in the [illegible] plete circle is one-half the number of poles, there being [illegible] null points per cycle.

In the Linear form, the poles are at intervals of a linear dis-



A Fig 3 B

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THE INDUCTOSYN

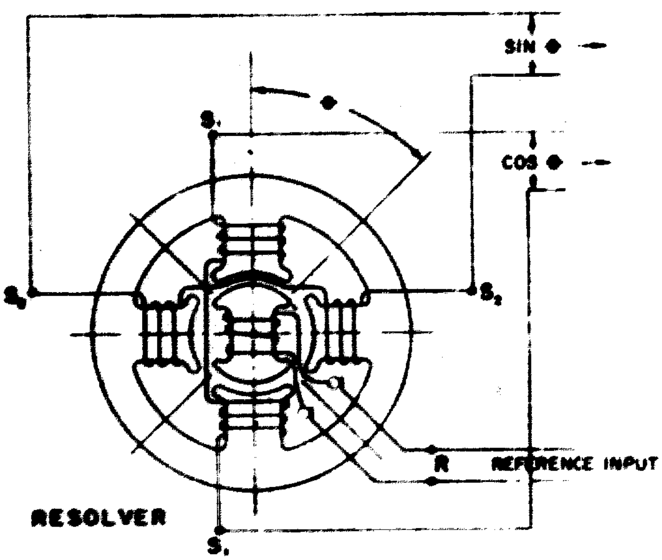

Fig. 4

tance (usually either .05 inch or 1 mm, which gives a distance per cycle of 0.1 inch or 2mm). In its present form, 64 or 96 poles are provided on each of the Linear Inductosyn slider (stator) windings. The stator output voltages are

$$\sin \frac{2\pi x}{s} \text{ and } \cos \frac{2\pi x}{s},$$

where x is the linear displacement and s is the pole spacing.

The output signals derived from the Inductosyn are the result of averaging over the total number of poles; thus the effect of small residual errors in individual conductor spacing is compensated if the spacing error throughout the whole pattern is cyclic. In the Rotary Inductosyn, only cyclic errors in spacing

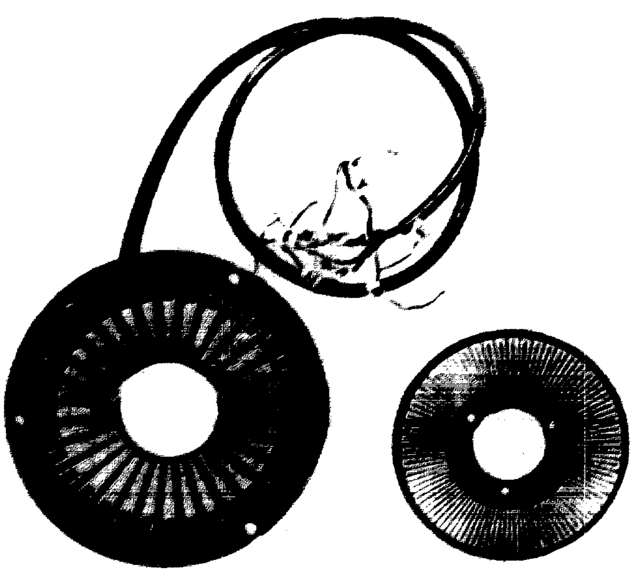

Fig. 5

can exist, since the pattern is continuous. In the Linear Inductosyn, non-cyclic errors are possible, and extreme care is exercised in manufacture to minimize them.

Figure 6 illustrates how the output voltage is produced in the Inductosyn windings. The illustrations show schematic cross sections of single input and output windings. The direction of current flow on the input winding is ⊙ out of the paper and ⊕ into the paper. In (A) the input and output conductors are at minimum separation and a maximum current is induced in the output winding, as shown by the positive peak of the coupling curve in (C) directly below the first turn of the output winding.

In (B) the output winding has been displaced ¼ cycle to the right. In this position, the input conductors are midway between the output conductors, there are equal induced currents in opposite directions, which cancel, and the resulting output current is zero, as shown by the intercept of the coupling curve in (C).

A further ¼ cycle displacement of the output winding would give another maximum induced current, this time in the opposite direction, as shown by the negative peak of the coupling curve in (C).

If the displacement, x, is measured from the (A) position the coupling curve shown represents the cosine x output. A second winding displaced ¼ cycle from the first gives a sine x output.

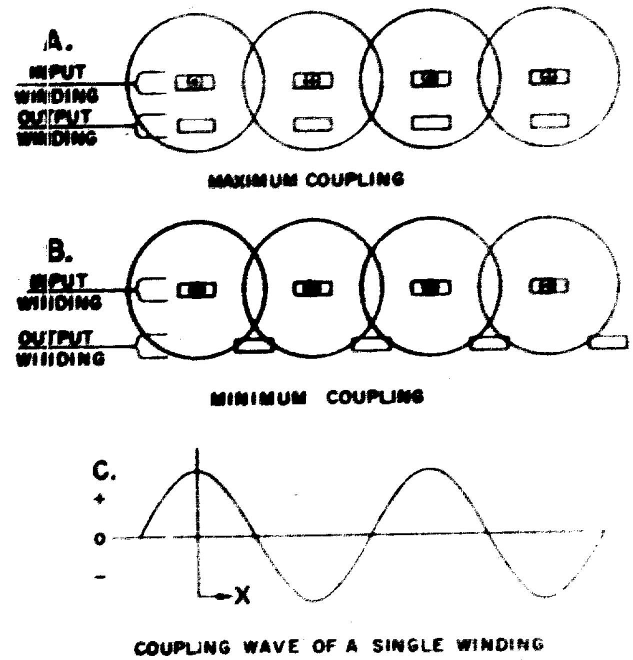

Fig. 6

In general, the induced output voltage will not be a pure sine or cosine function, but it will be a periodic function with a period equal to double the input conductor or pole spacing. It may therefore be considered to be the sum of a sine (or cosine) curve plus a series of harmonics. With suitable design of conductor widths and spacings in the Inductosyn patterns, these harmonics are suppressed to less than 0.1% of the fundamental, and a nearly perfect sine wave coupling is achieved.

The two-phase operation is achieved by providing two independent windings on the Inductosyn stator. It is important to note that the 90° phase difference between these windings is in space phase and not in time phase. One set of windings is displaced in one-quarter space cycle from the other; the windings on the stator are arranged in groups to permit this displacement. Figure 7 shows schematically how this is accomplished. The resulting coupling waves to the two windings are shown. If a vertical line is drawn through this pair of curves, two specific

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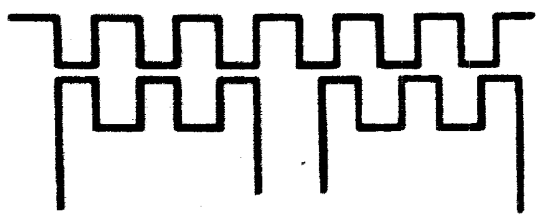
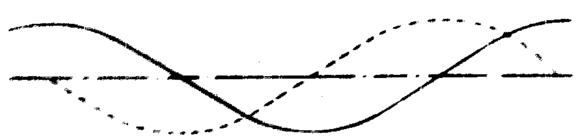
voltage values correspond to the points where this vertical line cuts the two curves, and this pair of values is unique for the position represented by the vertical line. If, now, voltages equal to this particular pair of values are introduced into the two stator windings of a receiver, the output from the rotor will be a maximum when it is in the position corresponding to this vertical line, and will be a null at a point 90° distant. Thus, the output from the rotor of a receiver Inductosyn is also a sine curve. This is the normal means for operating the Inductosyn to either follow another transmitting Inductosyn or to reproduce a desired position from a control. Any method of producing these voltages can be used to provide the input data. Several methods of doing this will be discussed below.



TWO WINDINGS IN 90° SPACE PHASE.



TWO PHASE COUPLING WAVES

Fig. 7

The principle of the Linear Inductosyn is exactly the same as that of the Rotary, linear distances being equivalent to angles. The stator of the Linear Inductosyn is known as the slider, and the rotor as the scale. Either slider or scale may comprise the moving element, the other being stationary. In the Rotary Inductosyn, the induced signals are averaged over the entire circular pattern, in the Linear Inductosyn, the signals are averaged over a distance corresponding to 32 or 48 cycles. The Linear Inductosyn scale is provided in 10-inch sections, which may be mounted end-to-end and connected in series to provide as long a scale as may be necessary for the intended purpose.

ACCURACY OF THE INDUCTOSYN

The performance of a data device may be stated in a number of different ways, and it is important to distinguish these from one another in considering the literature. In particular, the term "accuracy" is often misused. The definitions of the terms used in connection with the Inductosyn are as follows:

Accuracy: This term describes the precision to which a position of the data element may be measured or reproduced with respect to an absolute external dimensional reference of either angle or length. It may be:

1. The error between the position of the transmitter Inductosyn and the receiver Inductosyn in a servo system (in terms of either angle or distance)

2. The error between the position of the moveable element of an Inductosyn with respect to its stationary element and the position corresponding to the ratio of the sine and cosine voltages at either:

a. The outputs of the Inductosyn stator or

b. The inputs of the Inductosyn stator

in terms of either angle or distance.

Accuracy defined in this way can be considered only in terms of a complete system, and this is the most stringent possible definition of the term.

Repeatability: This term describes the precision to which a mechanical position, or a sine/cosine voltage ratio corresponding to a position can be repeated on successive trials.

Sensitivity: This term describes the smallest movement which can be reproduced or measured by the device; its definition requires a statement of useful signal-to-noise ratio and system bandwidth, defining the time over which the observation is made.

On the basis of the above definitions, the performance characteristics of present Inductosyn components (in terms of peak errors—not rms) are as follows:

ACCURACY:

Rotary Inductosyn: The Rotary Inductosyn is available in three different sizes, and in the form of individual discs which may be directly mounted on a specific item of equipment or in complete assemblies for coupling to a shaft. Because of residual mechanical errors involved in the complete assemblies the stated accuracies are not as high as for direct mounting.

Rotary Induction Accuracy

	Rotary Assembly	*Direct Mounting*
3" Size	± 10 seconds of arc	± 5 seconds of arc
7" Size	± 5 seconds of arc	± 3 seconds of arc
12" Size	± 2 seconds of arc	± 1 second of arc

Linear Inductosyn: The Linear Inductosyn is presently made with a conductor spacing of .05 inch (0.1 inch cycle), or 1 millimeter (2 mm. cycle), the slider has either 64 or 96 poles and is approximately four inches in length, the scales are furnished in 10-inch lengths.

The accuracy of the Linear Inductosyn is ± .0001 inch for the inch scale and ± .0025 mm. for the metric scale over the entire length of the scale. The reference is the U. S. National Bureau of Standards inch and meter, and the reference temperature is 68° Fahrenheit.

Scale segments of the Linear Inductosyn are customarily arrayed end-to-end to provide for measurement over large distances. The accuracy of such an array is dependent upon the precision to which the individual segments are positioned.

REPEATABILITY:

Rotary Inductosyn:	*Direct Mounting*
3" Size	1 second of arc
7" Size	.6 second of arc
12" Size	.2 second of arc

Linear Inductosyn: .00001 inch (10 micro-inches) or .00025 mm. (0.25 microns)

SENSITIVITY:

Rotary Inductosyn:	*Direct Mounting*
3" Size	0.25 second of arc
7" Size	.15 second of arc
12" Size	.05 second of arc

Linear Inductosyn: .000002 inch (2 micro-inches) or .00005 mm. (.05 micron)

The above stated sensitivities are for signal-to-noise ratios and bandwidths consistent with normal operation of Inductosyn servomechanisms and other systems. Measurements made with reduced bandwidth (one second time constant) on the 3" size Rotary Inductosyn have indicated a noise level equivalent to a rotation of .001 second of arc.

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A PROPOSAL FOR:

A STUDY OF FLUORESCENT LAMP FLICKER REDUCTION TECHNIQUES

Although the requirements of the general illumination system in the Advanced Film Viewing Light Table have been achieved, we have noted several inherent characteristics of a cold cathode lamp which tend to degrade the quality of its light output. One of the most troublesome from an interpreters viewpoint is a flicker which is an exaggerated stroboscopic effect. We believe that further improvement in the techniques necessary to reduce flicker can be made, and therefore propose a program to study the phenomenon and conduct a comparitive evaluation of flicker reducing electronic circuits.

The flicker referred to in this proposal is not to be confused with an "on" - "off" type of flicker that occurs in fluorescent lamps when the gas inside the lamp is not properly ionizing. When the conditions are not conducive to proper lamp illumination it is reasonable to expect incomplete ionizing of the gas inside the tube. However, it has been our experience that flickering in a cold cathode lamp is induced by a ringing condition in the secondary of the transformer. The circuit ringing tends to allow the lamp to operate in an unstable condition which results in variation in its light output. The ringing frequency appears to be characteristic of the particular lamp grid/transformer configuration. In instances when the transformer-lamp circuits have been selected to eliminate ringing in the secondary, a large controllable dimming ratio could be obtained. For example, we have conducted tests where laboratory cold cathode lamps have been dimmed to ratios of 300:1 without a trace of any flicker even when the tube was being observed

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directly (without a diffuser).

We would like to study the flicker phenomen in greater depth. Several reasons prompt this proposal. First, with more knowledge of the cause and circuit design, greater dimming ratios could be reliably achieved in different configurations of the light sources as well as those having larger or smaller illumination areas. Presently one way of reducing flicker is to provide more diffusing by either providing a diffuser with less transmission capability or to make the light box deeper which would result in better diffusing. A scheme that would eliminate the flicker entirely would increase light output and result in smaller packaging.

Secondly, we propose to study techniques that will compare illumination and dimming when alternating and direct current is passed through the lamps. Special compensating networks will be tried in the secondary of the operating transformers to eliminate or minimize the ringing condition. Lamps of different pressure will also be tried to determine how this parameter effects the conditions that prevail during flicker.

The final product of this study program will be to provide a greater insight for the circuit designer in the cause of the flicker phenomenon and the circuit design techniques by which flicker can be reduced or eliminated.

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ADVANCED FILM VIEWING LIGHT TABLE

A PROPOSAL FOR A HIGH INTENSITY GENERAL ILLUMINATION SYSTEM

The purpose of this proposal is to suggest increasing the light output of the cold cathode lamp in the general illumination system to 3,500 foot lamberts so that the high intensity tracking light sources can be eliminated.

Technical discussions with the cold cathode manufacturer inducate that a light level of 3,500 ft. lamberts or greater is feasible in a configuration of an 11" X 40" light source such as is found in table #3. In fact, intensities as high as 5,000 foot lamberts are feasible, but this level of light would require several transformers that are larger than those we are now using. However, by eliminating the tracking light source, the area permitted for transformer packaging is increased to dimensions of 6 1/2" X 4 1/4" X 15 1/2". We propose to develope a special transformer that will fit into the above space and match this transformer with a cold cathode lamp capable of delivering 3,500 ft. lamberts.

The length of tubing inside the lamp holder would have to be increased by 75% or a total length of approximatily 73 feet to obtain a light output of 3,500 foot lamberts. Based on our current application andexperience a transformer with a rating of 13 kv at 60 ma. would be required. While the actual illumination level that can be achieved will be determined experimentally, and would depend on the actual lamp design, it is conceivable that levels of 3,500 foot lamberts or more are feasible. The light intensity on each half of the microscope could be varied with an optical filter if required.

Advantages to this approach.

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1. It would make the light table less complicated and more reliable since the individual tracking light sources and their associated mechanisms would be eliminated.

2. It would provide more illumination when viewing the film without the microscope if it is needed.

3. Production quantities of the light tables would cost less.

4. The problems with variation in color temperatures by dimming the incandescent lamps are eliminated. Color correction would not be required.

<u>Disadvantages to this approach.</u>

1. Unit will be heavier due to increased transformer size. (By approximately 10 pounds.)

2. Surface temperature due to increased light output may require special ventilation, to keep it below the specification of 110°F in an 80°F ambient. A more detailed study of this factor will be required during the design.

3. Increased voltage inherntly will require more detailed design consideration to make sure the unit is completely free from shock hazards.

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ADVANCED FILM VIEWING LIGHT TABLE

A PROPOSAL FOR A FLOURESCENT HIGH

INTENSITY ILLUMINATION SYSTEM

An experimental intensity value of 3,500 foot lamberts has been determined by [redacted] personnel to provide adequate illumination of the film area with an average density of 2 as viewed with the [redacted] stereoscope.

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We now propose to replace the two incandescent condenser-type light sources described in paragraph 4.1.2 of the technical exhibit with two flourescent lamp sources.

These flourescent light sources will illuminate a surface area 110 mm X 110 mm and produce 3,500 ft. lamberts or more.

The proposed unit would consist of two individual cold cathode type light sources housed in a light box approximately three fourths of an inch thick and approximately four inches square. The lamp grid tubing will be approximately 7 mm in diameter and the unit will be completely potted in a clear potting compound to insure a rugged package. The high intensity light source will have an opaque divider down the center of the lighted area which will divide the lighted area into two sections 55mm X 110 mm. In each section there will be a cold cathode lamp capable of illuminating the 55 mm X 110 mm area to 3,500 foot lamberts or greater. Each lamp will be individually controlled with a dimmer capable of reducing the illumination intensity from maximum intensity to 50% of maximum intensity.

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The 4" square light box will track in the X and Y direction similar to the method proposed for the condenser type light sources. The larger area of uniform light would provide the necessary background for the required rhomboid separation on the microscope. Each individual lamp would be controlled from a transformer which would be capable of delivering approximately 2 kv at 30 ma. The lamp intensity would be controlled by changing the input voltage to each transformer.

Advantages to this approach:

1. Light source will be smaller in depth than the proposed condenser light sources allowing the distance between the general illumination system and microscope to be smaller.

2. The flourescent lamp will operate at a lower temperature than an incandescent lamp. Potting of the flourescent lamp will also reduce the operating temperature. This will reduce or eliminate the background noise created by blower motors required for cooling the incandescent lamps.

3. The proposed light source is simpler than the incandescent lamp because it will consist of a single bulb (no lens assembly). While it poses several design problems it should cost less in production quantities

4. The color temperature will not change for the cold cathode lamp as it is dimmed. Dimming ~~changes~~ the incandescent type sources is associated with a change in color temperature.

5. The proposed flourescent lamp will provide a larger area of high intensity light than the two 40 mm illuminated areas provided by the incandescent type light sources.

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6. Tolerances on the X and Y movement of the tracking light sources will be made less critical by illuminating a larger area.

7. The low voltage, high current D.C. power supplies required by the ~~flourescent~~ incandescent lamps will not be required.

Disadvantages of this approach.

1. The flourescent lamps are more hazardous than incandescant lamps because the lamps require higher voltages. The design must consider the problem of supplying power leads in such a manner as to minimize the wear due to movement of the light source.

2. The flourescent lamp will increase the weight of each table. Two additional transformers approximately 3" high X 2 1/2" wide X 4" long, will have to be packaged into the table base.

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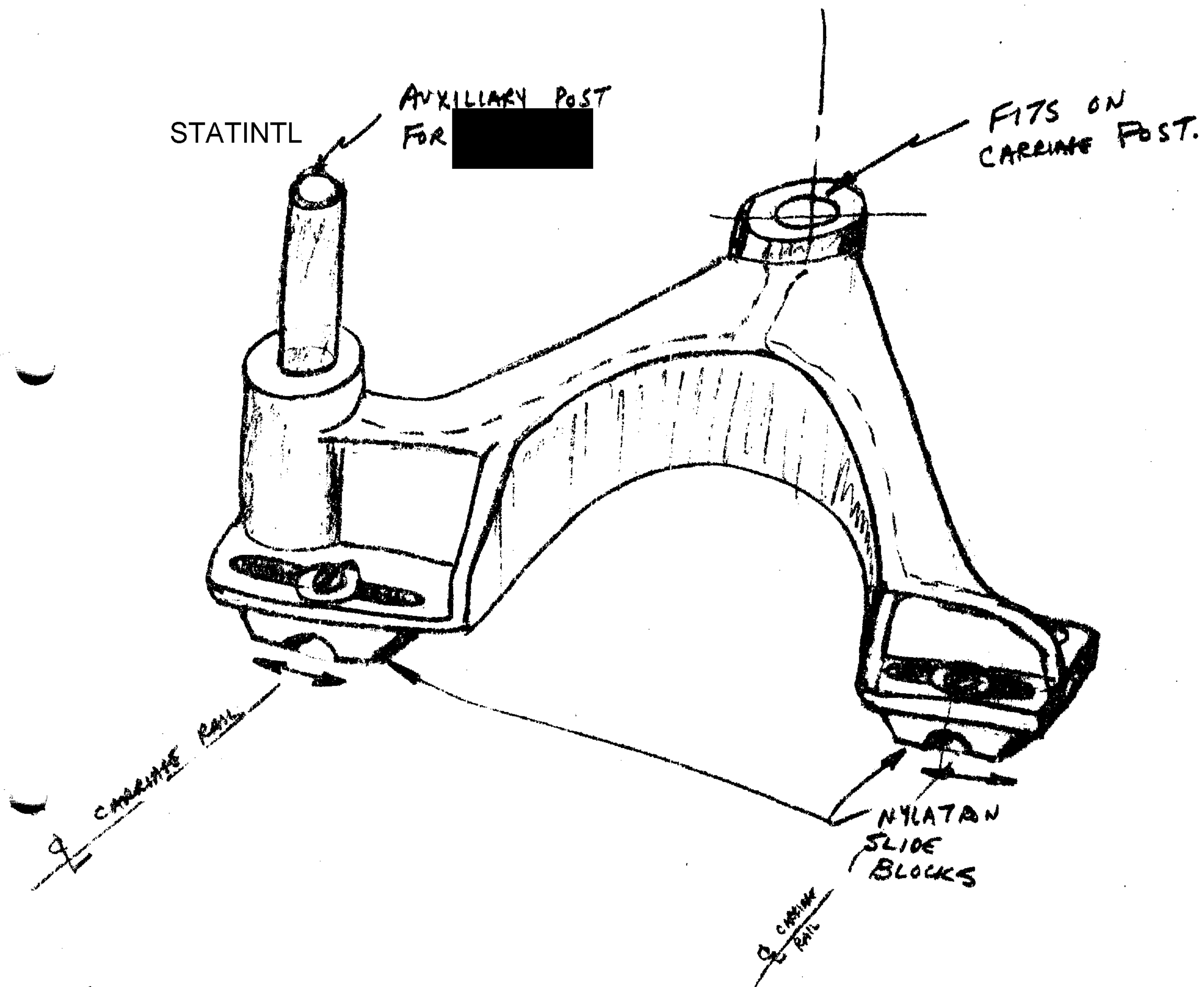
STATINTL [redacted]

5-27-65

FOR [redacted] STEREOSCOPE STATINTL
IN 90° POSITION



ADVANTAGES

1. RUGGED 3 POINT SUPPORT FOR [redacted] STEREOSCOPE. STATINTL
2. STEREOSCOPE POSITION RELATIVE TO CARRIAGE SUPPORT BARS IS IDEAL.

DISADVANTAGES

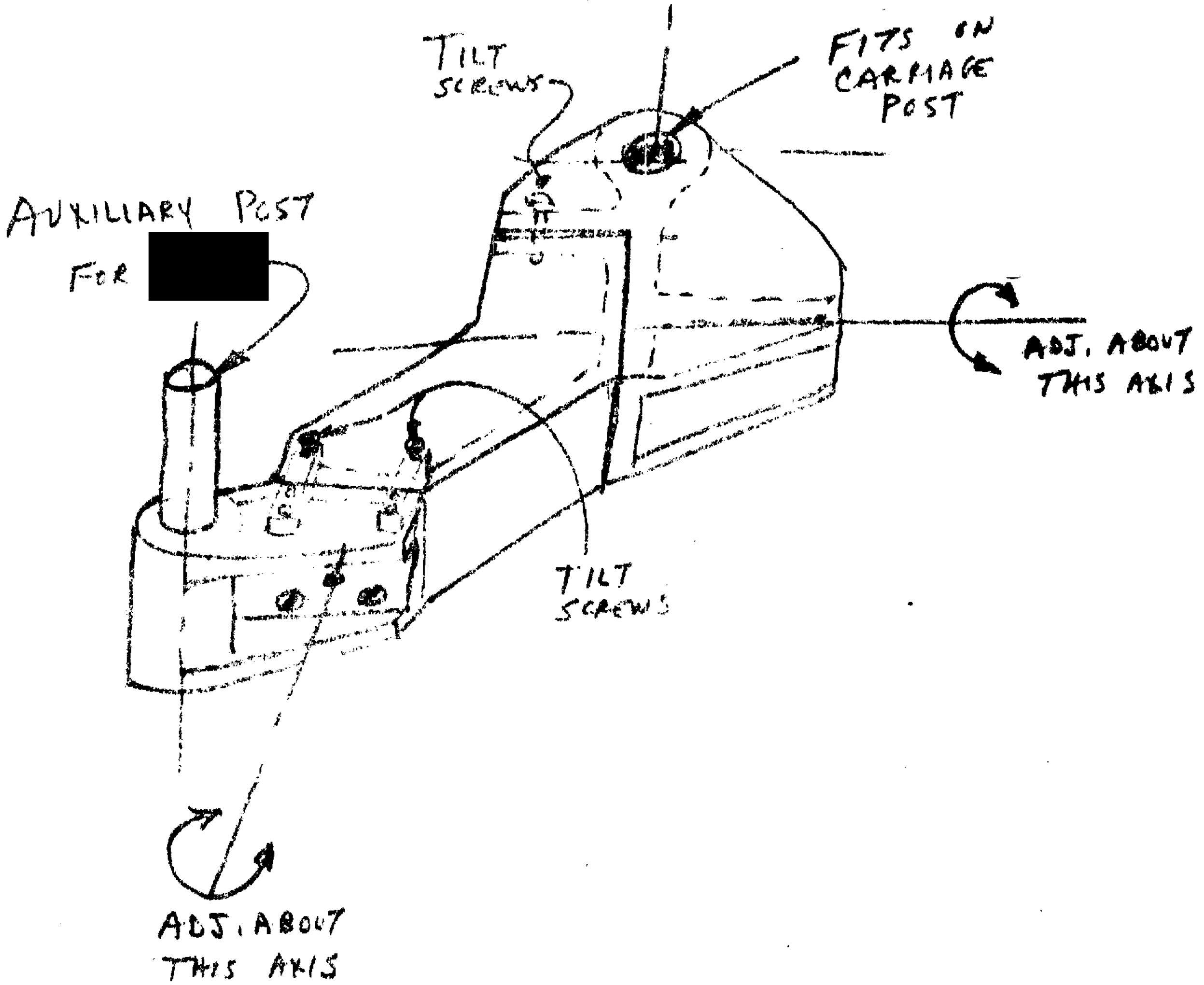
1. CUMBERSOME PART TO HANDLE AND PLACE IN POSITION.
2. PROBABLY WILL NOT SLIDE SMOOTHLY TO PERMIT ACCURATE "X" & "Y" MEASUREMENT
3. "X-X" HANDWHEEL MAY BE INACCESSIBLE
4. COMPLICATES CABLE DESIGN FOR HIGH INTENSITY LIGHT SOURCE MOVEMENT.

 [redacted]

18 (1)

5-27-65

AUXILIARY SUPPORT POST FOR [redacted] STEREOSCOPE IN 90° POSITION



ADVANTAGES

1. EASY TO INSTALL AFTER TILT CORRECTIONS HAVE BEEN SET.
2. FREE ACCESS TO X-X HANDWHEEL.
3. "X" & "Y" MOVEMENTS SHOULD BE ACCURATE.
4.

DISADVANTAGES

1. CANTILEVER OVERHANG SITUATION REQUIRES COMPENSATING DEVICE TO OVERCOME DEFLECTIONS
2. MICROSCOPE POSITION DISPLACED ABOUT 2" TO RIGHT OF STANDARD POSITION.
3. ADDITIONAL MACHINE WORK